STUDIES ON CILIATES FROM MARINE MUSSELS IN JAPAN

II. *MADSENIA CYCLINA* N. SP. AND *EPISTYLIS ELONGATA* STOKES

MITSUO UYEMURA (上村三男)

Zoological Institute, Tokyo University of Literature and Science

ONE PLATE

(Received May 23, 1938)

This paper is a continuation of my last paper dealing with *Ancistruma japonica* (1937). The hosts are the saltwater mussels, *Mactra veneriformis* Reeve, *Cyclina sinensis* Gmelin, *Paphia philippinarum* Adams & Reeve and *Meretrix meretrix* Linnæus, which are found commonly in the seas around Japan.

The localities where I obtained the materials and the methods employed are the same as in the previous paper.

Before going further I wish to express my hearty thanks to Prof. Dr. Yaichiro Okada for his valuable advice during my investigation.

DESCRIPTION

Genus *Madsenia* Kahl 1934

Madsenia cyclina n. sp.

(Pl. 21, figs. 1–2, 4–5)

This ciliate is found abundantly in the mantle cavity and on the gills of *Cyclina sinensis* Gmelin.

The body is elongate-oval or spoon-shaped and somewhat flattened, measuring 50–65 μ in length and 18–24 μ in breadth. Towards the anterior third, the body becomes narrower, and ends in a pointed anterior extremity which forms a proboscis, while the posterior two-thirds is rather wide and ends in a rounded extremity.

The oral (dorsal) surface is rather convex, while the aboral (ventral) surface is more or less flattened. The left border is convex in the dorsal or ventral view.

The peristomal groove is located close to the right border, extending from near the anterior end to about the middle of the body. It is elongate-oval in shape, pointed anteriorly and widening gradually towards the posterior end, where the mouth-opening exists.

There are two rather thick fibres on either side of the oral groove which are well revealed by staining with Heidenhain's hæmatoxylin. The fibre that runs along the left margin of the peristome is curved at its end like the figure 6 and borders the oral aperture (Pl. 21, fig. 5). The cilia are distributed uniformly over the body, and are arranged in longitudinal rows, which are 8–10 in number on the dorsal surface, and 11–12 on the ventral. The cilia in the anterior region and in the oral groove are rather long, being 8–11 μ. They become gradually shorter towards the posterior region of the body where they measure about 5–6 μ. There is a single long caudal cilium or filament (about 20 μ in length) at the posterior extremity of the body.

The plasm contains rather large granules which make the detection of the macronucleus and micronucleus hard in the living organism. These can however be demonstrated easily by staining with Heidenhain's hæmatoxylin. The macronucleus is single, and located always at about the anterior fourth of the body; it is round, and measures 8–11 μ in diameter. It consists of various-sized chromatin granules. The micronucleus is single, and situated in front of the macronucleus. It is a compact spherical body, measuring 1.2–1.5 μ in diameter. The contractile vacuole is single, and is located close to the posterior extremity. Many food vacuoles are always found in the middle and posterior regions of the body. They contain algæ, bacteria and sloughed-off epitheial cells of the mussel.

The animalcule swims very rapidly when mounted on a slide, darting through the water in a straight line or in curves. It usually moves with its ventral surface in contact with the substratum, and in this position are found most specimens when fixed; but it appears to be able to swim to either direction with equal ease.

Remarks: The present ciliate appears at the first glance to be a form which belongs to the genus *Uronema*, in the general form of its body, with a long caudal bristle at its posterior end and in the location of the oral groove. However, the cilia in the oral groove do not form an undulating membrane, as it is the case in that genus.

The animalcule also resembles *Anophrys elongata* Biggar and *Entodiscus indomitus* Madsen that are found in the intestine of the sea-urchin. Kahl (1934) has proposed to establish a new genus *Madsenia* to include *Entodiscus indomitus* Madsen, *Anophrys elongata* Biggar and other intestinal ciliates found in sea-urchins, with *Madsenia* (*Entodiscus*) *indomitus* Madsen as a typical species. According to this classification, the above-mentioned animalcule must be put in the genus *Madsenia* because of the following characters, viz.: the elongated body, the long peristomal groove, which extends from near the anterior end to just before the middle region of the body on the right border, and the contractile vacuole being situated in the posterior region of the body.

The animalcule may be easily distinguished from *Madsenia* (*Anophrys*) *elongata* Biggar by the following features: the body is much smaller and provided with a long caudal cilium; the narrower anterior third is not transparent and flexible; the macronucleus and the micronucleus are located at the anterior one-fourth of the body while they are near the centre of the body in *Madsenia* (*Anophrys*) *elongata* Biggar.

From *Madsenia* (*Entodiscus*) *indomitus* (Madsen) the animalcule may be distinguished in: (1) the shape of the narrower anterior portion, (2) the size of the cytoplasmic granules in the body, (3) the position of the macronucleus and the micronucleus, (4) the character of the movement, and in (5) the flatness of the body.

Thus, the present animalcule seems to be new to science. The specific name refers to the abundant occurrence of this animalcule in the mussel, *Cyclina sinensis* Gmelin.

Epistylis Ehrenberg 1838

Epistylis elongata Stokes

(Pl. 21, figs. 3, 6)

This species is found in a colony on the gills of the mussels *Mactra veneriformis* Reeve, *Paphia philippinarum* Adams & Reeve and *Meretrix meretrix* Linnæus. Each colony is composed of from six to twelve individuals. The body of the individual contracts, but the stalk does not, so the contraction and expansion of the members of the colony take place independently from one another.

The body, when fully extended, is elongate conical, two or three times as long as broad, and tapers towards its point of junction with the stalk. The ciliated oral disc is rather projected, the peristomal border is very thick and fairly well everted, when fully extended. Just below the peristomal border there is a slight constriction, forming a narrow groove. Delicate transversal striations are found all over the body. When contracted, the transverse folds appear on the whole surface of the body.

The stalk has a core made up of muscle fibres, and branches dichotomously. There is no transversal striation upon its pellicle.

The extended organism has the following dimensions: length of body, 76–91 μ; width of body, 29–33 μ; diameter of stalk, 9–11 μ.

The mouth which opens at the base of the oral disc is nearly triangular. The vestibulum is large and ellipsoid, and provided with an undulating membrane which is divided into five or six cirri at the distal margin, when the body is fully extended.

The endoplasmic granules are quite large and contained mostly in the posterior region. Sometimes the granules are scattered sparsely here and there in the body and not strictly confined to the posterior zone. The macronucleus is located in front of the middle region and is horseshoe-shaped, and consists of various-sized chromatin granules. The contractile vacuole is single and located anteriorly. There are several food vacuoles that contain bacteria, algæ and sloughed-off epithelial cells of the mussels, located mostly in the middle region of the body.

Remarks:—From the features described above, it is clear that the organism in question falls under the genus *Epistylis*. Among the members of this genus, it resembles closely *Epistylis vaginula* Stokes and *Ep. elongata* Stokes in its general appearance and in having transversal striations all over the body. But it may be distinguished from *Ep. vaginula* Stokes by the following characters. The peristomal border is thicker; the body does not show a snout-like projection, nor does it cover its stalk when contracted; the stalk is not so profusely branched.

From *Ep. elongata* Stokes, the present species appears to differ in that the macronucleus is not band-shaped and in that the body is less slender and smaller. But it is rather difficult to separate the present form from that species by these features, and I have decided after some considerations to identify the organism with *Ep. elongata* Stokes.

LITERATURE

Biggar, R. B. (1932). Studies on ciliates from Bermuda Sea Urchins (With introduction and notes by D. H. Wenrich). Journ. Parasit., Vol. 18, 252–257.

Engelmann, T. W. (1862). Zur Naturgeschichte d. Infusionstiere. Zeitschr. f. wiss. Zool. Bd. 11.

Kahl, A. (1933). Die Tierwelt der Nord- und Ostsee. Teil II. C_3: Ciliata libera et ectocommensalia. Leipzig.

—— (1934). Die Tierwelt der Nord- und Ostsee. Teil II. C_4: Ciliata entocommensalia et Parasitica.

—— (1935). Die Tierwelt Deutschlands. 30. Teil. Peritricha u. Chonotricha, Jena.

Keiser, A. (1921). Die sessilen peritrichen Infusorien u. Saktorien von Basel und Umgebung. Rev. Swiss. Zool., 28.

Madsen, von H. (1931). Bemerkungen über einige entozoische u. freilebende marine Infusorien der Gattungen *Uronema, Cyclidium, Cristigera, Aspidisca,* u. *Entodiscus* gen. nov. Zool. Anz., Bd. 96, 3/4, 99–122.

Powers, Ph. B. A. (1933). Studies on the ciliates from sea-urchins. 1. General Taxonomy. Biol. Bull., 65, 106–121.

—— (1933). Studies on ciliates from sea-urchins. II. *Entodiscus borealis* (Hentschel), (Protozoa, Ciliata), behavior and morphology. Ibid., 122–136.

Uyemura, M. (1937). Studies on ciliate from marine mussels in Japan. 1. Sci. Rep. of the Tokyo Bunrika Daigaku. Sect. B, Vol. 3, No. 53.

EXPLANATION OF PLATE 21

Figs. 1–3. Photomicrographs; all were fixed in Schaudinn's fluid and stained with Heidenhain's hæmatoxylin:

Figs. 1–2. *Madsenia cyclina* n. sp. Dorsal view. ×1100.

Fig. 3. *Epistylis elongata* Stokes. ×160.

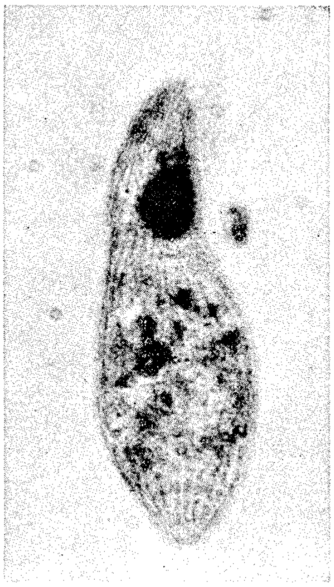
Fig. 4. *Madsenia cyclina* n. sp. Ventral view. ×850.

Fig. 5. *Madsenia cyclina* n. sp. Dorsal view. ×850.

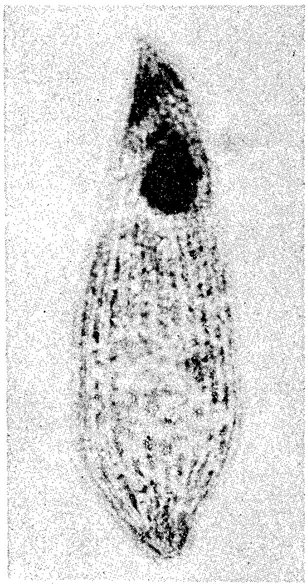
Fig. 6. *Epistylis elongata* Stokes. ×820.

Annot. Zool. Japon., Vol. 17, Nos. 3, 4 (Dr. A. Oka Jubilee Numbers)

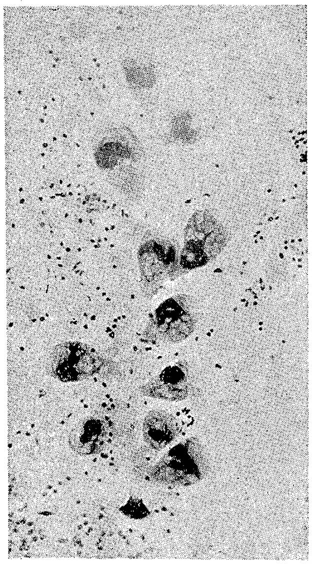
PLATE 21



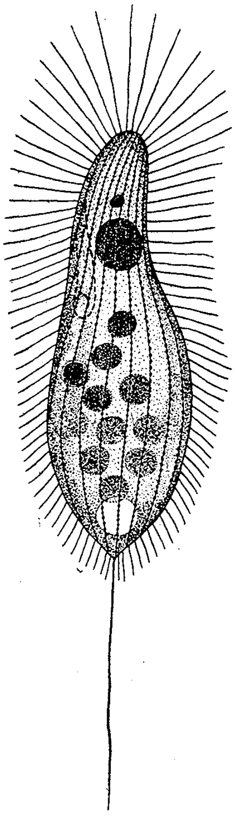
1



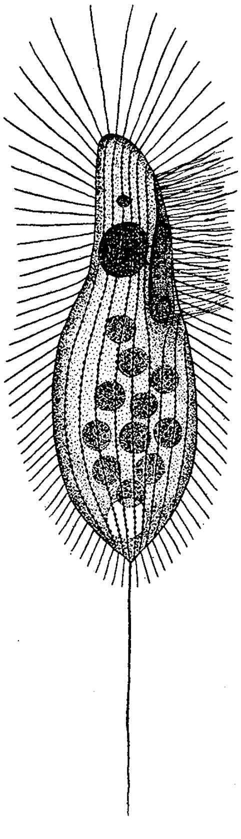
2



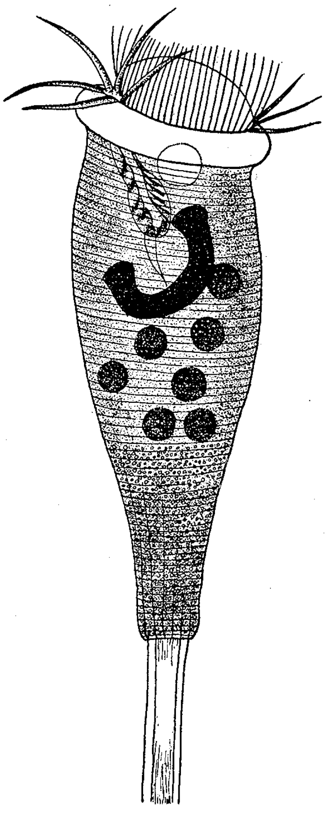
3



4



5



6

M. UYEMURA: STUDIES ON CILIATES FROM MARINE MUSSELS IN JAPAN